



# beetles

Science and Teaching for Field Instructors

## Student Activity Guide

# Mind Pie

In this Assessment Routine, students use a Mind Pie chart to express how comfortable and confident they feel about certain topics and activities they will encounter during the field experience. The chart provides the instructor with some information about the group, which they can use to inform their instruction. It also gives students an idea of what to expect from the field experience. This activity does not explicitly illuminate student misconceptions, rather, it serves as an opportunity for students to access and reflect on their prior knowledge and experience.

### Students will:

- Evaluate their own prior knowledge
- Observe the group's knowledge base for each topic
- Look for any patterns in the groups' responses
- Build an understanding of the science theme of the day

### Grade Level:

Grades 3-8. Adaptable for younger or older students.



### Timing:

about 15 minutes

### Related Activities:

Mind Pie can be used in the invitation or reflection stage of any lesson.



### Materials:

#### For instructor:

A poster-sized Mind Pie Chart  
Bag of pebbles and/or leaves (if hard to find outside)

### Tips:

To ensure a successful experience, review the teaching tips found on page 2 and throughout this guide.



### Setting:

An area large enough to create a group circle. Ideally one that has small pebbles and leaves around.

## NEXT GENERATION SCIENCE STANDARDS

For additional information about NGSS, go to page 6 of this guide.

This activity does not provide the opportunity for students to engage in science practices, to learn disciplinary core ideas, or to apply crosscutting concepts. It's an assessment tool that can help an instructor learn more about their students' competencies in science practices and understanding of core ideas and concepts.



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# Mind Pie

## ACTIVITY OVERVIEW

Mind Pie	Learning Cycle Stages	Estimated Time
Introducing the Activity		5 minutes
Students Fill out the Mind Pie	Invitation	2–5 minutes
Debrief and Wrapping Up	Invitation	5 minutes
<i>Optional</i> - Mind Pie Return	Reflection	(5 minutes)
<b>TOTAL</b>	Reflection	<b>15 minutes</b>

**Field Card.** On page 9 of this guide, you'll find a condensed, pocket-sized version of the lesson that you can carry along on the hike.

**Read the Instructor Support Section.** Beginning on page 6, you'll find more information about pedagogy, student misconceptions, science background, and standards.

**Create the Mind Pie: When you create your mind pie chart, use big ideas that you will address that day/week.** You can use different mind pies each day to preview that day, or one mind pie at the beginning of the week that you can revisit again and again. See page 5, *Suggested Mind Pie Categories*, for theme-based ideas for Mind Pie sections.

**Assessment Opportunity.** Take note of any categories where your group is growing knowledge, to help inform your decisions about teaching during the hike. For example, if the Mind Pie chart shows that your students feel they have less experience in scientific discussion, consider focusing on that during your field experience, and point out to students when they're having a scientific discussion. Be aware that students often put pebbles in categories where they have a lot to learn because they're not necessarily aware of potential growth (or of their own misconceptions).

TEACHING TIPS

## Introducing the Activity

1. **Explain that *Mind Pie* will help us learn about the group.** Gather students in a circle around the *Mind Pie* poster to explain the activity. Tell students this activity will help give everyone a sense of what the group already knows about, feels comfortable doing, and what things will be really new. It will also give them a chance to hear a little bit about what they will be doing that day (or multiple days).
2. **Explain each section of the pie.** Give students clear and simple explanations for each pie section. Be careful, however, that you don't explain each topic so thoroughly that students think they understand it based on your introduction. You just want them to understand what you're asking them to respond to.
3. **Explain how to show what they know: pebble = solid understanding, dead plant piece = room to grow, blank = no experience.** Tell students that if they feel really comfortable and "solid" with a topic, they should set a pebble in that section. If they know what a topic means, but realize that they have "room to grow," they should put a small piece of a stick or dead leaf in that section. Finally, if there's a topic they have never heard of before, or feel very inexperienced with, they should leave it blank.
4. **Challenge students to be honest to make the activity worthwhile.** The *Mind Pie* is meant to help students think about their own learning, and to help the instructor and students gauge the group's experience and understandings. Explain that sometimes students put all or mostly stones because they think that putting plants might make them look bad, but then the mind pie becomes useless. And awareness of what you don't know is a good thing. This is a group process, not a graded test, and no one will know who put what where.
5. **Discourage tossing items and accidentally kicking the Mind Pie.** Tell students to carefully place one item at a time in a section, and not to step over the poster.

## Students Fill Out the Mind Pie

1. **[Optional] Tell students to record individual responses in journals.** Ask students to copy the mind pie to a blank journal page so they can create a record of their own learning. Tell them to fill out their own personal Mind Pies. They can use pen to shade in their level of confidence for each category (darker shading = more confident).
2. **Students place materials on group Mind Pie.** Allow about 2 minutes for students to place materials on Mind Pie sections. Depending on the size of your group, you can have students work all at once or split the group so only a handful of students are filling in the pie at one time.

### TEACHING NOTES

**Blank versus No Response.** If you are concerned that sections which are left blank will be indistinguishable from sections where students simply forget to place an item, you can have students use one object for each of the three responses: a pebble for solid knowledge, a plant for room to grow, and dirt for no familiarity.

**Encourage honesty: Otherwise, you may end up with a lot of pebbles and not many plants.** To encourage more thoughtfulness, humility, and honesty, you might want to tell students that each person should put down at least 3 plant pieces.

**Assessment Opportunity.** You might also have students record their pre- and post-pies in their journals. Collect them to view how their learning and understanding has changed over the week or day.

**Mind Pie provide students with an overview of what's to come.** Seeing what's in each pie piece gives students an idea of what to expect during the field experience.

## Wrapping Up

1. **Look for patterns and discuss.** Ask students the following questions to see what they notice about the group as a whole:
  - ▶ *What do you notice about our Mind Pie?*
  - ▶ *What can you say about our group based on this information?*
  - ▶ *In what area(s) is there more awareness of room to grow?*
  - ▶ *What area(s) does this group seem particularly strong in?*
2. **Reassure students as necessary about any particular topics.** If you notice any topic in particular that includes a lot of plants, reassure them that it's OK and that we all have room to grow in what we know.
3. **Explain they'll experience these topics & later reflect on growth.** Close the activity by explaining to students that they will experience these topics throughout the day, and later see where they may have grown.

### **Optional: Mind Pie Return (at end of field experience or whole program)**

1. **Do the Mind Pie again & reflect on Learning.** At the end of the experience, bring out the group Mind Pie (or personal responses, if you had your students complete them), and repeat the activity. Ask students if they feel like they learned something new in any particular category, if they changed their mind about how much they know about a particular category.
  - ▶ *What do you notice about our Mind Pie now?*
  - ▶ *What can you say about our group?*
  - ▶ *What areas have you/we grown in?*
  - ▶ *Are you surprised by any of your/our growth?*

## Suggested Mind Pie Categories

Mind Pies can have 4, 8, or 6 slices depending on how many categories you choose to use. Use a mix of “I like” categories and “I can” categories, so students reflect both on their abilities and their preferences. The following are some suggested category statements.

### 1. Science Practices:

- I can participate in a scientific discussion.
- I like exploring outside.
- I work well on a team.
- I like trying to solve nature mysteries.
- I can make an explanation from evidence.

### 2. For an Ecosystems, Matter, & Energy-themed hike:

- I can explain decomposition.
- I can explain how matter and energy move through ecosystems.
- I can explain one or more of these:
  - Food chains
  - Food webs
  - Food pyramids

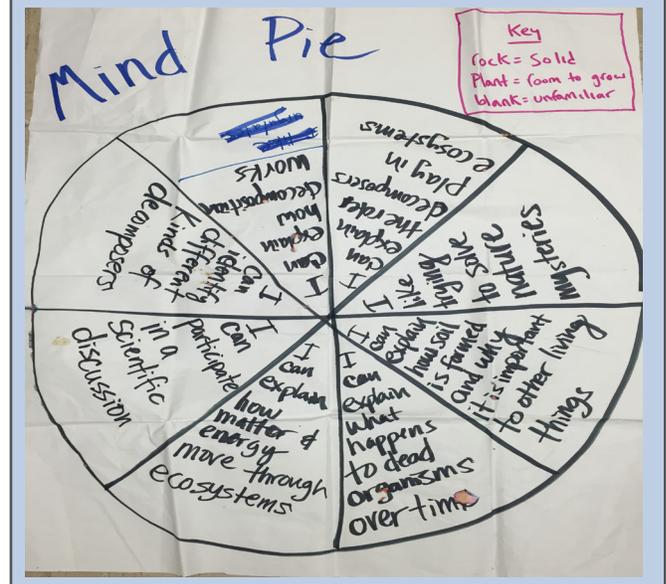
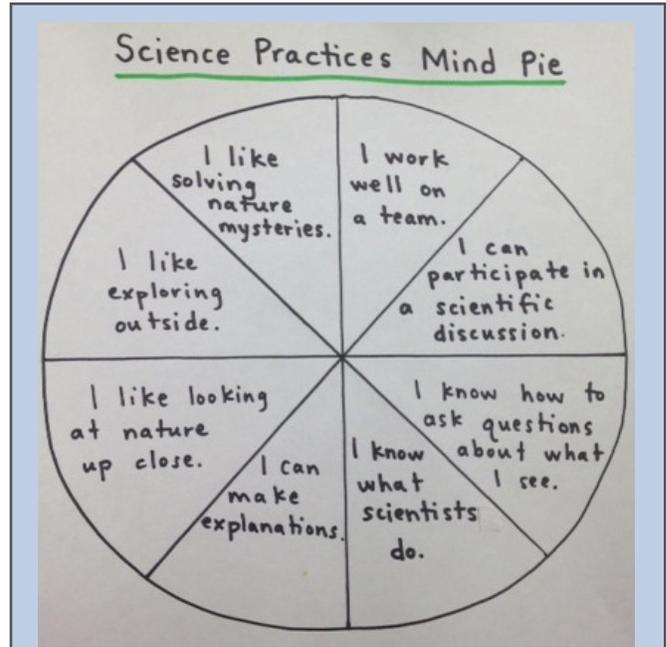
### 3. For a Decomposition-themed hike:

- I can explain decomposition.
- I can explain how soil is formed, and why it's important to other living things.
- I can explain what happens to dead organisms over time.
- I can identify different kinds of decomposers.

### 4. For an Adaptations and Evolution-themed hike:

- I can explain how an organism's adaptations help it survive in its habitat.
- I can explain how changes in a habitat can cause changes in adaptations.
- I can explain how types of living things evolve over deep time.
- I can explain how all organisms are related and how they are different.
- I can explain how the shape of an organism's body part (like a beak) shows what it's used for.

Example Mind Pies



## Instructor Support

### Background Information

Assessment practices create a continuous flow of information between teacher and student to guide the next steps in learning. Informal assessment should be a part of every instructor's practice with students. Through assessment, an instructor can get an idea of each group and individual's understandings, misconceptions, levels, and interests. Instructor can then use this ongoing feedback to inform what they do with the students. This can help make a more meaningful and relevant learning experience for a group. *Mind Pie* can give instructors information about student understanding that can inform their lessons and help them give a particular group a more meaningful and relevant learning experience.

**Ideally, assessment should happen in all stages of learning.** It's useful for an instructor to assess student understanding before new material is introduced, during the learning process (to monitor how students are developing understanding ideas), and after a lesson (to see how well the student understands the new material, and to assess the effectiveness of the teaching). *Mind Pie* can be used before and after learning experiences to improve instructor practice.

Doing *Mind Pie* before a learning experience gives an instructor an idea of a group's perception of their own understanding of specific ideas and their comfort with skills relevant to science practices. Use this information to inform the lessons and learning experiences that occur during that experience.

For students, a pre-assessment opportunity, such as *Mind Pie* provides the chance to reflect on what they don't know, or would like to know more about. It also allows them to access prior knowledge that will help them to engage in thinking about related experience and ideas.

Assessing student learning during a lesson allows an instructor to modify the learning experience in time to make a difference—rather than discover an issue just as it's time to move on to another subject. Assessing student learning during a lesson can take place through listening to students' ideas within discussion, talking to individual students, and examining student-produced text, such as journal entries.

After a lesson, *Mind Pie* gives an instructor information about how much students have learned and how their own comfort with engaging in science practices has shifted during the course of a field experience or lesson.

**Involving students in assessment helps them envision performance goals and understand what is needed for improvement.** For students, *Mind Pie* is a visual way to represent and think about their own learning. The physical act of placing a pebble on the "I can participate in a scientific discussion" slice of the *Mind Pie* diagram gives a student some ownership of their experience and language to describe new skills they've learned—and seeing that as a goal for their learning experience is significant. If students understand the work standards that are expected of them they can take charge of their own learning, and their motivation to learn is greatly increased.

### Connections to the Next Generation Science Standards (NGSS)

Many BEETLES student activities are designed to provide opportunities for

**Why teach science practices?**  
 "Engaging in the practices of science helps students understand how scientific knowledge develops...It can also pique students' curiosity, capture their interest, and motivate their continued study..."  
 -National Research Council *Framework for K-12 Science Education*. Focus on these science practices will help to ensure a more scientifically literate public who will, hopefully, be better able to make thoughtful decisions.

the “three-dimensional” learning that is called for in the NGSS. To experience three-dimensional learning, students need to engage in scientific practices to learn important science concepts (Disciplinary Core Ideas) and make connections to the big ideas in science (Crosscutting Concepts). In short, students should be using the tools of science to explore and investigate rich phenomena, trying to figure out how the natural world works.

*Mind Pie* by itself is not a three-dimensional learning experience—it’s an assessment tool for instructors and an opportunity for students to reflect on their own knowledge. However, the activity can deeply enrich student learning by providing an opportunity to think about their competencies with specific skills and understandings that relate to the NGSS.

***Mind Pie and connections to science practices.*** If you include science practices (or descriptions of skills inherent to those practices) on your Mind Pie, students can learn that those skills are integral to learning about science. If the Mind Pie is returned to later, students can reflect on the growth in their own skills and literacy with science practices. If possible, point out to students when they’re doing something that was included in the Mind Pie during the field experience, so they can recognize those skills and contextualize them within their own experiences. They might not realize in the moment that they are doing something connected to the Mind Pie (like participating in a science discussion). According to *A Framework for K–12 Science Education*, on which the NGSS are based, it’s important for students to reflect on the nature and practices of science—what science is and how it is done. Including science practices in *Mind Pie* and using it as a pre- and post-activity is one way for students to build understanding of how their own learning connects to scientific processes of generating knowledge about the natural world.

***Mind Pie and connections to Disciplinary Core Ideas.*** Including sections of the Mind Pie related to Disciplinary Core Ideas shows students that understanding those concepts can be a learning goal. It’s important to phrase these sections of the Mind Pie to be about what students can *do*, not what students *know*. A student might feel solid and place a rock on a section that says “I know what decomposition is,” having heard the definition of “decomposition,” but owning the idea, “I can explain how decomposition works” signifies a deeper level of learning and mastery of the material and shows students that the goal is to be able to explain concepts, not just know them.

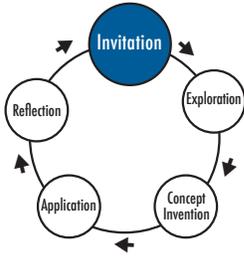
The information you get from students’ initial placement of objects on the Mind Pie should inform the level at which you engage students in content that day. At the end of a lesson or field experience, use your observations of how students’ placement of objects on the Mind Pie changed to help determine what content students need more exposure to, and to learn about whether their perception of their competency in science practices has changed. This is useful information—both in planning future activities for that group of students and for designing learning experiences for other groups of students in the future.

## NOTES

**About the Next Generation Science Standards (NGSS)** The development of the Next Generation Science Standards followed closely on the movement to adopt nationwide English language arts and mathematics Common Core standards. In the case of the science standards, the National Research Council (NRC) first wrote a *Framework for K-12 Science Education* that beautifully describes an updated and comprehensive vision for proficiency in science across our nation. The *Framework*—validated by science researchers, educators and cognitive scientists—was then the basis for the development of the NGSS. As our understanding of how children learn has grown dramatically since the last science standards were published, the NGSS has pushed the science education community further towards engaging students in the practices used by scientists and engineers, and using the “big ideas” of science to actively learn about the natural world. Research shows that teaching science as a process of inquiry and explanation helps students to form a deeper understanding of science concepts and better recognize how science applies to everyday life. In order to emphasize these important aspects of science, the NGSS are organized into three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas (DCI’s). The DCI’s are divided into four disciplines: Life Science (LS), Physical Science (PS), Earth and Space Science (ESS) and Engineering, Technology and Applied Science (ETS).

Read more about the Next Generation Science Standards at <http://www.nextgenscience.org/> and <http://ngss.nsta.org>

## NOTES



***Mind Pie* is an Invitation and Reflection activity to be done before and/or after a sequence of learning experiences.**

## Activity Connections

*Mind Pie* could be used before and after any BEETLES activity, or any sequence of activities that explore ideas related to similar content. For a different pre-post activity that focuses specifically on deepening student understanding of when they are using science practices, check out the BEETLES student activity *What Scientists Do*.

## FIELD CARD

Cut out along outer lines, & fold along the centerline. This makes a handy reference card that will fit in your pocket.

### Mind Pie

#### Introducing the Activity

1. Explain that *Mind Pie* will help us learn about the group.
2. Explain each section of the pie.
3. Explain how to show what they know. (rock = solid understanding, plant = room to grow, blank = no experience).
4. Challenge students to be honest to make the activity worthwhile.
5. Discourage tossing items and accidentally kicking the Mind Pie.

#### Students Fill Out the Mind Pie

1. [optional] Students record individual responses in journals.
2. Students place materials on group Mind Pie.

#### Wrapping Up

1. Look for patterns and discuss:
  - ▶ *What do you notice about our Mind Pie?*
  - ▶ *What can you say about our group based on this information?*
  - ▶ *What area(s) is there more awareness of room to grow?*
  - ▶ *What area(s) does this group seem particularly strong in?*
2. Reassure students as necessary about any particular topics.
3. Explain that they'll experience these topics & later reflect on growth.

#### Optional : Mind Pie Return (at end of hike or week)

1. Do the Mind Pie again and reflect on learning:
  - ▶ *What do you notice about our Mind Pie now?*
  - ▶ *What can you say about our group?*
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